UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Climate Change, Extreme Weather, and Electric System Reliability	)	Docket No. AD21-13-000

COMMENTS OF ADVANCED ENERGY ECONOMY

Advanced Energy Economy (AEE) respectfully submits these comments in response to the Federal Energy Regulatory Commission's March 15, 2021 Supplemental Notice of Technical Conference Inviting Comments in the above-captioned proceeding. AEE applauds the Commission's decision to focus attention on the impacts of climate change and extreme weather events on electric reliability and the performance of the electricity system.

AEE is a national association of businesses that are making the energy we use secure, clean, and affordable. AEE is the only industry association in the United States that represents the full range of advanced energy technologies and services, both grid-scale and distributed. Advanced energy includes energy efficiency, demand response, energy storage, wind, solar, hydro, nuclear, electric vehicles, and more. As we explain in more detail in these initial comments, these technologies can be used individually and in combination to address pressing challenges created by climate change and extreme weather events.

In general, climate change and extreme weather events, combined with other factors, are putting new stresses on the power system that require the re-examination of past practices for planning and operations and the consideration of new tools to increase the flexibility and resilience of the grid in the face of these new challenges. According to the U.S. Government Accountability Office (GAO), "climate change is expected to affect every aspect of the electric grid – from generation, transmission, distribution, to demand for electricity."[1] An in-depth assessment of climate change and extreme weather stressors on the power system is needed so that system planners and operators, resource owners, regulators, and other actors can take the appropriate measures to fortify our power grid against the known hazards of climate change and extreme weather. The February 2021 severe winter weather in Texas and the August-September 2020 severe heatwave facing California and the Southwest are just the most recent examples of extreme weather events, previously unprecedented in scope and scale, stressing system operations and grid assets. The Commission (in some cases alongside the North American Electric Reliability Council ("NERC")) has examined many of these kinds of events and the different resource types that helped ease their impacts and keep the lights on before, including the January 2011 Texas and Southwest U.S. cold weather event, the September 2013 heatwave in PJM, and the January 2014 Polar Vortex in PJM.[2] The Commission should build on these learnings, recognizing at the same time that the past is not prologue when it comes to climate change and extreme weather events; planning practices and grid assets must be more flexible to address more frequent and more extreme weather and climate impacts like wildfires, floods, and other events.

In these high-level initial comments, AEE first offers several broad themes that the Commission should consider addressing during the two-day Technical Conference and in any future activities in this docket. Then, we offer initial responses to a certain number of the questions posed in the March 15 Supplement Notice issued in this docket.

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[1] GAO, Electricity Grid Resilience: Climate Change Is Expected to Have Far-reaching Effects and DOE and FERC Should Take Actions (March 2021), GAO-21-346, https://www.gao.gov/assets/720/712950.pdf

[2] *See, e.g.,* "Polar Vortex Review," NERC (Sept. 2014) available at https://www.nerc.com/pa/rrm/January%202014%20Polar%20Vortex%20Review/Polar_Vortex_Review_29_Sept_2014_Fina l.pdf

In particular, our comments highlight the key role that distributed energy resources and smart technologies, such as smart thermostats and appliances, can play in providing resilience value to individual customers and the broader electricity system in the face of climate change risks and extreme weather events. We provide examples of how distributed energy resources like solar plus storage have already demonstrated significant value in extreme weather events, and explain how expanding access to them can extend this resilience value more broadly and to more customers, including low income and historically disadvantaged communities. In addition, we provide several ideas in response to Question 12 in the Commission's Supplemental Notice regarding the role smart thermostats and similar technologies can play in fostering more active, dynamic, and visible demand response during extreme weather events. Voluntary conservation was critical to limiting the impact of the extreme heat event in California in August-September 2020, but as we discuss above, utilizing data and communications from smart technologies can expand this demand response and make it more usable and visible to grid operators during emergencies.

I. SUGGESTED AREAS OF FOCUS IN THIS PROCEEDING

Below we highlight several themes that the Commission should consider focusing on throughout this proceeding and during the June 1-2 Technical Conference.

A. How more extreme weather events and climate change are presenting increasing seasonal risks to the reliable operation of the electricity system.

In general, extreme weather events are challenging traditional reliability and resource adequacy risk assessment approaches that focus on a single peak event. The February 2021 extreme winter weather event in Texas that drove outages in the Electric Reliability Council of Texas (ERCOT) and Midcontinent Independent System Operator, Inc. (MISO) systems, for example, occurred during a season that Texas and MISO South have historically not experienced such extreme demand peaks. In the future, electricity systems will likely need to plan to be reliable and resilient to extreme weather events that create significant demand peaks and potential supply interruptions in all seasons.

One potential tool to address these seasonal challenges that the Commission may wish to consider is the development, or in some cases reintroduction, of seasonal reliability and resource adequacy products in wholesale markets. For example, seasonal energy, capacity, and ancillary services products should be considered to provide incentives for the development of new technologies and resources on the supply and demand-side to address these new challenges. Demand response and energy efficiency, in particular, can provide significant reliability and resilience value on a seasonable basis (*e.g.*, air conditioning loads, heating loads, lighting in winter months).

B. How well-designed broader regional wholesale markets can provide a better platform to deliver grid resiliency during extreme weather events.

Organized wholesale markets on a broad regional scale give grid operators greater ability to access resources over a broader geographic area, allowing them to rely on a more technically and geographically diverse set of generation resources that improves the overall resiliency and efficiency of the grid.[3] When extreme weather or a climate driven event (*e.g.*, wildfire, flooding) is impacting resources in one location, a large and strongly integrated regional grid allows operators to access available resources in other locations to maintain reliability and continuity of service. Expanding integrated regional wholesale markets that operate the transmission system over a broad single control area, with shorter settlement intervals to capture resource availability, gives operators more tools to access energy supply where it is available and deliver it to where it

[3] *See, e.g.,* Allied Associations Letter to Congress, March 17, 2021, https://www.naseo.org/Data/Sites/1/documents/policy/2021-03-17-multi-organizaton-letter-on-wholesale-markets.pdf

is needed. Related, as the Commission knows well, developing additional transmission to resolve congestion and access new resource areas gives operators still more tools to find energy where it is available during emergencies and extreme weather events. The robust transmission planning conducted inside broader regional wholesale markets helps develop needed transmission solutions to meet these resilience objectives. This robust approach to transmission also facilities the ability of available energy resources from a variety of sources (rather than just utility-owned resources) to access the grid on a non-discriminatory basis and serve emergent needs caused by climate change and extreme weather.

C. How to conduct vulnerability assessments to determine which resources are most at risk from climate change and extreme weather-related impacts.

Climate change and extreme weather impacts differ in scope and scale between resource types, and vulnerability assessments should be conducted that to the maximum extent possible capture the unique risks various climate impacts like wildfires and floods and different extreme weather events (severe heat and cold, snow, hurricanes) have on particular resource types. For example, during the severe winter event in Texas we saw highly correlated demands on natural gas-fired electric generators, and the natural gas supply and delivery system, all of which were seriously impacted by the freezing temperatures. In another example, thermal power generators that face high demands in hot and dry summer weather may also rely heavily on water for cooling, which could be subject to drought impacts.[4]

D. How advanced energy technologies, ranging from options like energy storage to smart devices and distributed energy resources, can mitigate the threat to individual customers and the electricity grid posed by climate change and extreme weather.

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[4] Davis, M., Clemmer, S., Union of Concerned Scientists, Power Failure: How Climate Change Puts Our Electricity at Risk and What We Can Do (April 2014)

Distributed Energy Resources ("DERs"), such as solar paired with battery storage, can provide important resilience benefits that advance public safety, bolster the effectiveness of demand response programs addressing emergency situations, and provide customers who utilize these resources greater ability to safely withstand prolonged power outages. Recent events in Texas as well as last summer's rolling blackouts in California highlight the need for much greater demand-side participation to ensure that local resources at the grid edge are able to meaningfully support the grid and consumers during unplanned contingencies. It also demonstrated the need to ensure that critical public safety and health facilities, like fire stations and water treatment plants, can withstand prolonged grid outages.

The combination of innovation in advanced energy technologies, declining costs, increasing consumer demand, and state policies have resulted in the rapid development of DERs capable of providing a broad range of reliability services.[5] FERC's Order No. 2222 will further increase the business case for more widespread adoption of DERs, and sets the stage for DERs to facilitate greater demand-side participation and improve system performance and outcomes during extreme weather events.[6] Full implementation of Order No. 2222's charge that DERs be permitted to aggregate to provide all of the services they are technically capable of providing would advance the geographic diversity of resources and improve wholesale market operator access and visibility to local resources that can provide resilience in such events.

The experience of AEE member Sunrun, the nation's largest provider of residential solar and battery services, provides an illustration of how individual customer and grid resilience

[5] Wood Mackenzie Power & Renewables, United States Distributed Energy Resources Outlook: DER Installations and Forecasts 2016-2025E (June 2020), https://www.woodmac.com/reports/power-markets-united-states-distributed-energy-resources-outlook-der-installations-and-forecasts-2016-2025e-416181/?utm_source=gtm&utm_medium=article&utm_campaign=pandr&utm_content=wmpr_deroutlook2020

[6] Distributed Energy Resource Aggregations in Markets Operated by Regional Transmission Organizations and Independent System Operators, Order No. 2222, 172 FERC ¶ 61,247 (2020) ("Order No. 2222").

objectives can be brought to scale through the market and add yet another dimension to the consideration of the role of DERs. With the advent and growth of distributed battery storage, the potential for distributed energy resource facilities to bolster the resilience of the grid and of individual critical loads and public safety facilities is a current reality. For example, in Puerto Rico, after Hurricane Maria, Sunrun was able to work with local partners to outfit three fire stations on the island with donated battery storage and solar generation facilities. Facing rolling blackouts and sporadic availability of electric service from the grid, fire stations on the island relied on unpredictable diesel generators that operated for only a few hours each day. These donated solar and storage installations allowed for continuous power to those three initial fire stations, helping strengthen the public safety infrastructure at a time when the island was in a state of emergency and facing persistent challenges in providing basic necessities. Sunrun then extended its work on the island to providing solar plus storage systems to residences, easing the burdens on ordinary retail customers caused by the long-term restoration of the island's electrical grid.

This experience demonstrated the potential for an even larger role for these types of distributed resources in supporting the restoration of the grid and improving the resilience of neighborhoods or individual homes, businesses, and government facilities. DER facilities could be utilized to provide system-level peak capacity and ramping services; fast-responding dispatch filling the island's critical need for spinning reserves; automated inverter-based response to frequency deviations; peak capacity in transmission constrained areas; peak capacity on the distribution grid to reduce strain or the need for capacity expansion; voltage management on the distribution system; and neighborhood and site-level resiliency.[7]

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[7] *See, e.g.,* Sunrun IRP Direct Expert Testimony, Mr. Christopher Rauscher, Puerto Rico Public Service Regulatory Board Case No. CEPR-AP-2018-001 (filed October 23, 2019).

In addition, with the recent years of severe wildfires in California, the utilities have begun imposing Public Safety Power Shutoffs (PSPS) when the risk of electrified wires sparking a wildfire is high. The operational flexibility that DERs provide can be used to avoid the need for proactive power shutoffs. But when such shutoffs occur, DERs can allow homes, businesses, or critical public safety facilities to isolate from the grid and continue to power necessary functions. The economic risks associated with wildfires (e.g., the threat of bankruptcy from civil liability, constriction of available insurance) are significant, making DER solutions a potentially cost-effective investment.

Similarly, during the recent extreme winter weather in Texas, DERs like residential solar plus storage demonstrated value to customers able to access them, helping hundreds of households keep their lights on through utility load shedding events with thousands of hours of backup energy. Many of these customers were the only homes with power in their neighborhoods, with many instances of customers sharing their homes with neighbors without power, acting as de facto community resilience hubs.[8]

These and other climate change and extreme weather-related disasters have shown just how important it is to enact policies that put a priority on expanding access to on-site DER resilience solutions. The potential for growth in DER resilience solutions is much greater where policies give DERs the ability to provide grid services or participate in markets directly or through a DER aggregator, as Order No. 2222 envisions and requires. Grid services programs for DERs have also grown in the Northeast, with "Bring Your Own Device" (BYOD) programs enabling DER

[8] *See* AEE Webinar, Search for Resilience: Texas Blackouts, Policy Fallout, and How Advanced Energy Can Help (March 2021), *available at https://info.aee.net/search-for-resilience-texas-blackouts-policy-fallout-and-how-advanced-energy-can-help?utm_campaign=Webinar%3A%20Search%20for%20Resilience%3A%20Texas%20Blackouts%2C%20Policy%20Fallout%2C%20and%20How%20Advanced%20Energy%20Can%20Help&utm_content=157315748&utm_medium=social&utm_source=twitter&hss_channel=tw-403019655*

consumers to be compensated for helping achieve system peak reductions. These programs exist in nearly every state in New England and are helping to reduce grid costs and increase deployment of resilient batteries. In Massachusetts, the Connected Solutions program, in addition to an upfront battery storage incentive through the state's SMART program, allows customers to opt-in to a pay-for-performance peak reduction program.[9] In Vermont, Green Mountain Power offers a BYOD battery program to customers that pays an upfront incentive of $850/kW for three-hour discharge or $950/kW for four-hour discharge, including a potential $100/kW adder for battery storage retrofits to existing residential solar facilities located in areas with identified constraints.[10] These types of BYOD programs, which are stackable with other DER programs that allow customers to achieve bill savings or derive a value stream, are important tools in bolstering the value proposition for DER resilience projects. They are explicitly designed to provide not only the private value of back-up power to individual customers, but also the public good of providing grid services that benefit all ratepayers, achieving both private and public resilience outcomes.

Assessing the role of DERs should not be limited to reacting to natural disasters like hurricanes, unprecedented fires and floods, or extreme weather events, however. A proactive approach to DER policy will help ensure better resilience and customer protections before the next disaster, while delivering benefits to customers and the grid more broadly. Developing programs that leverage the capabilities and grid benefits of DERs bolsters the economic case for resilient, on-site DER systems, as compared to using them solely for stand-alone backup purposes. An integrated approach to DER utilization expands the benefits of adopting DERs beyond just the individual customer by helping the grid operate more efficiently under normal conditions and

[9] *See* National Grid's Connected Solutions website, *available at* https://www.nationalgridus.com/MA-Home/Connected-Solutions/BatteryProgram

[10] *See* Green Mountain Power's Website, *available at* https://greenmountainpower.com/rebates-programs/home-energy-storage/bring-your-own-device/

respond more nimbly to system emergencies. Additionally, capturing all of the value stream that comes from using customer sited DERs for grid services expands the universe of customers who can make the economic case for investing in DER resilience. Optimizing DERs' ability to help the grid also addresses equity concerns by expanding access to these services to customers that might not be able to afford on-site energy resilience when it comes at a premium above their existing monthly energy expenditures.

E. How to increase access to DERs and other smart home resiliency options for underserved and vulnerable populations.

The Commission should also examine ways (both within its jurisdiction and otherwise) in which the industry and policymakers can increase access to DERs to underserved and vulnerable populations. As witnessed after Hurricane Maria and the recent events in Texas, public health conditions can deteriorate quickly without access to electricity and clean water. Thousands of people perished in the days and weeks after both storms due to degraded conditions, including lack of electricity and the loss of water treatment facilities. The Fourth National Climate Assessment, for example, explains that low-income communities, communities of color, and older adults and children "are often disproportionately affected by, and less resilient to, the health impacts of climate change."[11] Distributed energy resources can promote wealth-building opportunities in frontline communities.[12]

Optimizing DERs' ability to provide all of the services to the grid they are capable of providing, as discussed in the previous section, can also address equity concerns by providing new revenues that lower the cost of providing DERs and thus expanding access to them to customers

[11] U.S. Global Change Research Program, Fourth National Climate Assessment (November 2018), https://www.globalchange.gov/nca4
[12] Union of Concerned Scientists, Principles of Equitable Policy Design for Energy Storage (April 2019), https://www.ucsusa.org/resources/principles-equitable-policy-design-energy-storage

that might not be able to afford on-site energy resilience when it comes at a premium above their existing monthly energy expenditures. Order No. 2222 as explained above, is one key step in optimizing the use of DERs, as are the bring your own device and other programs discussed in the previous section.

F. How time of use rates can provide temporal benefits and decrease the risk of outages resulting from extreme weather events.

As noted above, climate change and increased extreme weather events are expected to affect the frequency and intensity of peak electricity demand, across seasons. During the recent extreme winter storm event, Texas' power grid experienced record-breaking winter electric demand. Time of use rates provide time-varying price signals that increase with demand and allow customers the voluntarily adjust their power consumption in response to those signals. These rate structures incentivize consumers to decrease demand during peak hours, thereby allowing them to support grid flexibility and reliability while also enabling renewable and demand-side technologies.[13] With the costs of new technologies like smart thermostats and appliances and home energy management equipment declining and their adoption expanding, more and more customers have the ability to actively respond to these price signals than ever before.[14]

G. How demand response (DR) and energy efficiency (EE), in particular, can help the electric grid adapt to climate change and mitigate the impacts of extreme climate-driven weather events.

DR and EE have a proven and consistent track record of strong performance during emergency events. In PJM, where wholesale DR participation is more well-developed than many

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[13] International Renewable Agency, Time-of-Use Tariffs: Innovation Landscape Brief (2019), *available at* https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Feb/IRENA_Innovation_ToU_tariffs_2019.pdf?la=en&hash=36658ADA8AA98677888DB2C184D1EE6A048C7470

[14] AEE, Advanced Energy Now: 2021 Market Report (March 2021), *available at* https://info.aee.net/aen-2021-market-report

other regions, DR (along with wind energy) provided reliable and flexible performance during the 2014 Polar Vortex.[15] These technologies diversify the electricity generation mix and reduce the reliability risks that stem from dependence on solid, liquid, and gas fuels for power generation. The Commission should fully examine their value and how wholesale power markets can continue to encourage and integrate them in the system, which will improve resilience against climate and weather risks in the future.[16,17]

H. How to incorporate existing and emerging approaches to assessing the risks of climate change and extreme weather on utilities and electric systems developed and applied by the financial sector into regulatory approaches to these same risks.

The Commission may also wish to consider how existing and emerging risk management approaches developed by the financial markets are assessing the risks of climate change impacts on electric utilities and owners of electricity system assets. Both regulated and restructured markets must take into account the financial consequences of extreme events. The financial sector is increasingly demanding disclosure of climate-related risks, so that investors have visibility into a firm's level of relative climate risk. The U.S. Commodity Futures Trading Commission created a climate-related financial risk subcommittee in 2020 to provide insights and recommendations to market regulators and participants.[18] Larry Fink, CEO of the world's largest asset manager

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[15] PJM Interconnection. "Response to Consumer Reports on 2014 Winter Pricing." (September 2014), http://www.pjm.com/~/media/documents/reports/20140919-pjm-response-toconsumer-reports-on-2014-winter-pricing.ashx.

[16] AEE, The Benefits of Energy Efficiency Participation in Capacity Markets (April 2021), *available at* https://info.aee.net/how-to-optimize-energy-efficiency-benefits-in-wholesale-markets

[17] AEE, Enabling Cost-Effective Energy Efficiency in the Midcontinent ISO Resource Adequacy Construct (April 2021), *available at* https://info.aee.net/how-to-optimize-energy-efficiency-benefits-in-wholesale-markets

[18] Litterman, R., Remarks to the Market Risk Advisory Committee. U.S. Commodity Futures Trading Commission, (December 2019), https://www.cftc.gov/media/3181/MRAC_Litterman121119/download.

BlackRock, has cited climate-related risks as the driver of a "fundamental re-shaping of finance" in his annual letter to global CEOs.[19]

With respect to utilities and the electric industry, the electric industry has been identified by analysis as particularly vulnerable to climate risks.[20] Research from BlackRock's Investment Institute (co-authored by Brian Deese who is now director of the National Economic Council and will be directing development of the national strategy on climate-related financial risks) suggests that climate-risks are already present in utility stocks, but they haven't been adequately evaluated by investors.[21] BlackRock's research found price reactions of up to 1.5% and rise in volatility of 6% in the 30-day period after a hurricane made landfall and determined the extreme weather exposure for each power plant location, individually, and in the aggregate for a publicly traded parent company to determine the degree of climate risk.[22] The U.S. Global Change Research Project concludes that utilities are already subject to climate-related physical risks.[23] In addition, Rhodium Group and Four Twenty Seven, among others, are developing techniques to analyze likely climate hazards at the plant level.[24]

The general approach of the financial sector's response could provide a good template and analogy for how regulators approach the climate vulnerabilities of electric utilities. The Task Force for Climate Related Disclosures (TFDC) has standardized the way in which individual firms report

[19] Fink, L., A Fundamental Reshaping of Finance. *BlackRock* (January 2020), https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter
[20] Morehouse, C., Ameren, Xcel, Dominion, Duke among most at-risk from changing climate: Moody's (January 2020), https://www.utilitydive.com/news/ameren-xcel-dominion-duke-among-most-at-risk-from-changing-climate-mood/570789/.
[21] Bertolotti, A., Basu, D., Akallal, K., Deese, B.), Climate Risk in the US Electric Utility Sector: A Case Study. *BlackRock Investment Institute* (March 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3347746.
[22] *Id.*
[23] Zamuda, C., et al. (2018). Energy Supply, Delivery, and Demand in *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. U.S. Global Change Research Program, pp. 174-201. Doi: 10.7930/NCA4.2018.CH4.
[24] Larsen, K., Larsen, J., Delgado, M., Herndon, W., Mohan, S, (January 2017) Assessing the Effect of Rising Temperatures: The Cost of Climate Change to the U.S. Power Sector. Rhodium Group, p. 10-19. Retrieved at https://rhg.com/wp-content/uploads/2017/01/RHG_PowerSectorImpactsOfClimateChange_Jan2017-1.pdf.

their climate vulnerabilities,[25] and many utility holding companies have submitted reports based on the TFCD template to the Climate Disclosure Project (CDP). These reports are opaque and very few utility operating companies have engaged in similarly detailed reporting or assessment of climate risk to their assets and operations at a granular level, however.

The reliability and economic impacts of climate-related risks to the electric system are intertwined, which suggests that ensuring that public utilities who own and operate grid assets manage those risks in a way that protects shareholders and ratepayers is part of the overall mandate of regulators like the Commission to ensure that rates are just and reasonable. It is important for grid operators and owners to conduct climate stress tests on their assets to determine the vulnerability of their assets to perform under projected climate conditions (i.e., forward looking analysis, not the traditional regulatory approach of relying on historic data). The regulatory concept of prudence requires grid operator and owner managers to make good decisions based on what they know or should have known (known or knowable) at the time. Ratings agencies, insurance and re-insurance companies, and major private equity investors are all raising alarm that the risks of climate change need to be presently managed. It is reasonable for a utility manager to be aware of these trends in the financial sector and to be actively managing these risks.[26,27] While it may be helpful to develop additional regulation in some instances, it is equally important to establish the principle that climate and extreme weather risks are systemic and that regulators of the United States electric system have a present responsibility and authority to ensure that utilities are

[25] Task Force on Climate-related Financial Disclosures, (May 2019). 2019 Status Report. pp. 2. Retrieved at https://www.fsb-tcfd.org/publications/tcfd-2019-status-report/.
[26] Sabin Center for Climate Law and Environmental Law and Environmental Defense Fund, Climate Risk in the Electricity Sector, *available at* https://climate.law.columbia.edu/sites/default/files/content/Full%20Report%20-%20Climate%20Risk%20in%20the%20Electricity%20Sector%20-%20Webb%20et%20al.pdf
[27] *See* Sabin Center for Climate Law, Petition to the New York Public Service Commission for Performance of Statewide Utility Climate Change Vulnerability Studies (March 2021), *available at* https://climate.law.columbia.edu/sites/default/files/content/Petition%20for%20utility%20climate%20change%20studies%20-%20final.pdf

appropriately responding to those risks and making prudent investments and choices in light of those foreseeable and likely physical and economic impacts.

II. INITIAL RESPONSES TO SELECTED QUESTIONS FROM THE MARCH 15 SUPPLEMENTAL NOTICE

Below, AEE provides initial responses to certain of the questions posed in the March 15, 2021 Supplemental Notice of Technical Conference Inviting Comments.

1. What are the most significant near-, medium-, and long-term challenges posed to electric system reliability due to climate change and extreme weather events?

While several jurisdictions are undertaking grid modernization and looking at more advanced planning processes forecast future resources needs, not enough attention is being paid to the need to incorporate the best available climate science and expectations of more extreme weather into the planning processes at the state and federal levels. The NARUC/NASEO task force on comprehensive electric planning is a good example of this ongoing gap in the planning process. While the roadmap to system planning addresses several policy choices states may make about climate change, it does not explicitly incorporate consideration of climate-related impacts as a foundational point for system planning.[28] With few exceptions, utility planning processes tend to ignore the essential input of forward-looking climate data to anticipate likely future challenges. Recent hurricanes in the Atlantic, wildfires in California, and the recent events in Texas obliterate any distinction between near-term safety and long-term hazard. The hazards are already manifesting and worsening and will likely only grow in degree. In the medium-to-long term, for example, greater reliance on thermal generation sources increases the vulnerability of the electric

[28] NARUC-NASEO Task Force on Comprehensive Electricity Planning: "Blueprint for State Action," (February 2021), *available at* https://pubs.naruc.org/pub/14F19AC8-155D-0A36-311F-4002BC140969.

system to the effects of regional droughts and could have significant impacts.[29] Taking these kinds of risks into account will reveal the kinds of solutions needed to mitigate them in the future.

2. **With respect to extreme weather events (e.g., hurricanes, extreme heat, extreme cold, drought, storm surges and other flooding events, or wildfires), have these issues impacted the electric system, either directly or indirectly, more frequently or seriously than in the past, and if so, how? Will extreme weather events require changes to the way generation, transmission, substation, or other facilities are designed, built, sited, and operated?**

In one example of an assessment of how extreme weather events may drive changes in design, construction, siting, and operation of grid assets, following Hurricane Sandy, Consolidated Edison in New York (Con Edison) conducted a stakeholder processes to address how to plan the electric system in light of climate vulnerabilities. This process was the result of the settlement of a rate case in which Con Edison sought over $1 billion in grid hardening investments in response to Hurricane Sandy. As part of the settlement, the New York Storm Hardening & Resiliency Collaborative (consisting of Con Edison, Department of Public Service Staff, the City of New York, and multiple environmental and consumer groups) was formed to review Con Edison's proposed storm hardening investments. The Collaborative created a framework for climate vulnerability assessment, examined the applicability of non-wires resiliency strategies, and developed a robust cost-benefit analysis.[30] Following over five years of stakeholder work, ConEd released its Climate Change Vulnerability Study in December 2019.[31] The study evaluates a range of likely future climate pathways and concluded that more extreme events were likely to increase

[29] Union of Concerned Scientists, Confronting Climate Change in New Mexico: Action Needed Today to Prepare the State for a Hotter, Drier Future (May 2016), *available at* https://www.ucsusa.org/resources/confronting-climate-change-new-mexico

[30] Case 13-E-0030 *et al,:* Consolidated Edison Company of New York, Storm Hardening and Resiliency Collaborative Phase Three Report. (September 2015).

[31] Con Edison, (December 2019). Climate Change Vulnerability Study ("Con Edison Study"). Retrieved at https://www.coned.com/-/media/files/coned/documents/our-energy-future/our-energy-projects/climate-change-resiliency-plan/climate-change-vulnerability-study.pdf.

in the future and that planning protocols must be updated (*e.g.*, flood maps) to account for sea level rise, among other climate-driven factors.

In late December 2020, ConEd issued its first Climate Change Implementation Plan.[32] In its plan, ConEd detailed how it was utilizing the climate vulnerability study in different ways for planning its system, including using Representative Concentration Pathways (RCP) 8.5 projections for "temperature, precipitation, and related variables," while using the midpoint of RCP 4.5 and 8.5 sea level rise projections. ConEd's plan commits to update these climate projections "with new climate science at least every five years…" and will review the pathways annually "to determine if updates are necessary to reflect advances in climate science, policy changes, or other factors."[33]

3. Climate change has a range of other impacts, such as long-term increases in ambient air or water temperatures that may impact cooling systems, changes in precipitation patterns that may impact such factors as reservoir levels or snowpack, and rising sea levels among others. Will these impacts require changes to the way generation, transmission, substation, or other facilities are designed, built, sited, and operated?

Again, the Con Edison study provides an illustration of one process used and deliverable created in the area of climate vulnerability assessments. The Con Edison study considers how likely increases in ambient air temperatures will impact heating and cooling load--driving resource and planning decisions. In Con Edison's study, it notes that "higher internal operating temperatures increase the rate of aging of the insulation of electric equipment such as transformers, resulting in decreased total life of the assets. Higher internal temperatures, resulting from higher average and maximum ambient temperatures, also reduce the delivery capacity of electrical equipment such as transformers. In addition, higher ambient temperatures increase the operating temperature of

[32] ConEdison, "Climate Change Implementation Plan", New York Public Service Commission Case Nos. 19-E-0065 and 19-G-0066 (filed December 29, 2020) ("Con Edison Implementation Plan"), *available at* documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={F59D306D-F332-4669-B023-4EFE980F65E9}.
[33] *Id.* at p. 3.

overhead transmission lines, causing increased sagging."[34] Insufficient line clearance due to sagging is a safety risk and could result in the need to derate the equipment. Increased ambient temperatures, including increased humidity, caused by climate change can increase the demand for electricity for cooling, further exacerbating the impacts of increased ambient temperature on grid assets by increasing internal temperatures.[35] The Con Edison Implementation plan notes that "every electrical device on the Con Edison system has a specified rating based on a reference ambient temperature. Increases in ambient temperature could affect equipment ratings and cycling capabilities… A reduction in equipment ratings, absent measures to compensate, will result in a reduction in electric capacity in the electrical system."[36] Con Edison outlined several potential strategies to monitor and address the risks of increases in ambient temperature. It could:

- Install equipment capable of collecting, tracking, and organizing temperature data at substations to allow for location-specific ratings and operations.
- Make ground temperature data more accessible and track increases over time.
- Expand monitoring and targeting of high-risk vegetation areas.
- Continue to track line sag and areas of vegetation change via light detection and ranging (LiDAR) flyovers to identify new segments that may require adaptation.[37]

Con Edison also noted that it may need to update its design standards to account for changes in climate factors:

- Temperature: Standardize ambient reference temperatures across all assets for development ratings.
- Precipitation: Update precipitation design standards to reference National Oceanic and Atmospheric Administration (NOAA) Atlas for up-to-date precipitation data. Consider updating the design storm from the 25-year precipitation event to the 50-year event to account for future increases in heavy rain events.
- Sea level rise: Revise design guidelines to consider sea level rise projections and facility useful life. Continue to build to the higher of the FEMA + 3' level and the Category 2 storm

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[34] Con Edison Study, Executive Summary at p. 4.
[35] *Id.* at p. 42.
[36] Con Edison Implementation Plan at p. 6, n. 15.
[37] Con Edison Study at p. 46.

> surge levels at new build sites, as is current practice. Add sea level rise to the Category 2 maps to account for future changes and a greater flood height/frequency."[38]

Con Edison's Study provides a range of potential adaptation options for its electric assets against a variety of different climate-related hazards, as well.[39]

4. **What are the electric system reliability challenges associated with "common mode failures" where, due to a climate change or extreme weather event, a large number of facilities critical to electric reliability (e.g., generation resources, transmission lines, substations, and natural gas pipelines) experience outages or significant operational limitations, either simultaneously or in close succession? How do these challenges differ across types of generation resources (e.g., natural gas, coal, hydro, nuclear, solar, wind)? To what extent does geographic diversity (i.e., sharing capacity from many resources across a large footprint) mitigate the risk of common mode failures?**

Examining these types of failures is critical in the wake of the recent extreme winter weather event in Texas, where highly correlated demands on natural gas supply and the natural gas delivery system were reported a key contributor to outages.[40] The Con Edison study noted above also recognized the importance of a more distributed and resource diverse grid in addressing these types of reliability and resilience issues.[41] In particular, the study highlights the role that DER and customer-sited DER could play in providing geographic diversity benefits and lessening the strain on the centralized system from major, extreme weather events. The study also recognizes the role of policy in supporting customer decisions to utilize DER, and that extreme weather events have driven policy and individual consumer preferences in many areas to adopt a DER-focused strategy.[42]

[38] *Id.*
[39] *Id.* at p. 47-48, Table 6.
[40] Utility Dive, Weather-Related Outages Primary Cause of Texas blackouts, New ERCOT Data Finds (April 2021), available at https://www.utilitydive.com/news/weather-related-outages-primary-cause-of-texas-blackouts-new-ercot-data-fi/597928/
[41] Con Edison Study at p. 36 (Table 4) and p. 62.
[42] *Id.*

Finally, additional protocols on gas/power coordination would be another area for Commission focus. As noted above, the outages in Texas underscore the need for emergency plans regarding the gas system conditions and power system reliability given the potential for correlated on high demands on each during extreme winter weather events.

6. **How are relevant regulatory authorities (e.g., federal, state, and local regulators), individual utilities (including federal power marketing agencies), and regional planning authorities (e.g., RTOs/ISOs) evaluating and addressing challenges posed to electric system reliability due to climate change and extreme weather events and what potential future actions are they considering? What additional steps should be considered to ensure electric system reliability?**

While not a comprehensive list, AEE notes the following federal and state regulator activities relating to the impacts of climate changes and extreme weather events on the electric system reliability.

- In 2015, the U.S. Department of Energy convened the *Partnership for Energy Sector Climate Resilience*, a collaborative of 19 electric utilities supported by DOE in developing best practices for understanding climate-related vulnerabilities and establishing climate resilience.[43]

- The California Public Utilities Commission issued an order requiring utilities to include climate vulnerability assessments with their general rate case filings to inform evaluation of the prudence of grid investments in light of the climate-related challenges facing those utilities.[44]

- The New York Public Service Commission (NY PSC) has observed that the type of TFCD disclosure of climate risk would be far more useful if done at the operating company level.[45]

[43] US Department of Energy, *Climate Change and the Electricity Sector: Guide for Climate Change Resilience Planning* (September 2016), *available at* https://toolkit.climate.gov/sites/default/files/Climate%20Change%20and%20the%20Electricity%20Sector%20Guide%20for%20Climate%20Change%20Resilience%20Planning%20September%202016_0.pdf.
[44] California Public Utilities Commission, Rulemaking 18-04-019, Decision 20-08-046 (September 2020), *available at* https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M346/K285/346285534.PDF
[45] State of New York Public Service Commission, Order Instituting Proceeding. Case 20-M-0499 (October 2020), *available at* documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7b0FFF1374-0511-41AC-8262-56BED5FAC8CC%7d

- The City of New York, Environmental Defense Fund, Natural Resources Defense Council and Sabin Center just Petitioned the NY PSC to open a preceding to "comprehensively study the impacts of climate change on utility infrastructure."[46]

- In a recently approved rate case settlement in North Carolina, Duke Energy Carolinas has committed to establishing a working group, similar to the ConEd process, to evaluate the impacts of climate change on its distribution and transmission assets.[47]

7. Are relevant regulatory authorities, individual utilities, or regional planning authorities considering changes to current modeling and planning assumptions used for transmission and resource adequacy planning? For example, is it still reasonable to base planning models on historic weather data and consumption trends if climate change is expected to result in extreme weather events that are both more frequent and more intense than historical data would suggest? If not, is a different approach to modeling and planning transmission and resource adequacy needs required? How should the benefits and constraints of alternative modeling and planning approaches be assessed?

Reliance on historic data may capture trends in recent years, but fails to anticipate the trajectory of those continued changes over the long lives of grid assets, especially as extreme weather events become more frequent and more intense. Since carbon mitigation and adaptation can go hand in hand, it is important to assess a range of likely outcomes based on the range of potential actions to mitigate future contributions to climate change. As noted above, Con Edison's Study looks at the range of outcomes based on RCP 4.5 and 8.5, consistent with the TFCD approach to disclosing climate risks for firms discussed above.

Finally, a change in the one day in 10 years resource adequacy planning standard may be needed to incorporate the impacts of climate change and extreme weather events that create

[46] *See* Sabin Center for Climate Law, Petition to the New York Public Service Commission for Performance of Statewide Utility Climate Change Vulnerability Studies (March 2021), *available at* https://climate.law.columbia.edu/sites/default/files/content/Petition%20for%20utility%20climate%20change%20studies%20-%20final.pdf

[47] Order Accepting Stipulations, Granting Partial Rate Increase, and Requiring Customer Notice, p.27, North Carolina Utilities Commission Docket No. E-7, Sub 1214 (Issued March 31, 2021), *available at* *https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=b7bfd96b-6df7-4013-9054-d1ff7242588a*

outages that are protracted. As we witnessed in Texas, these extreme weather events are becoming commonplace and grid planners must develop and adopt new methods to account for these changes.

12. Mass public notification systems (e.g., cellphone texts, emails, smart thermostat notifications) are sometimes used in emergencies to solicit voluntary reductions in the demand for electricity. To what extent are such measures used when faced with emergencies related to climate change or extreme weather events, have they been effective in helping to address emergencies, and is there room for improvement?

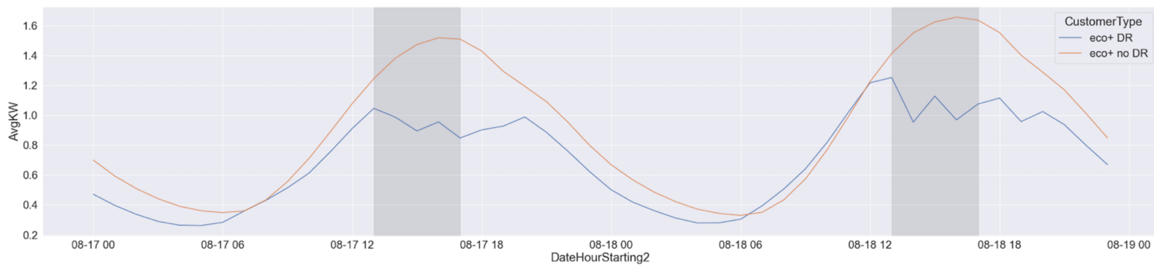
AEE offers the following information and recommendations on how to improve the solicitation of voluntary reductions in electricity usage through automation technology, which is now a viable and cost-effective way to address reliability emergencies. Such emergency response mechanisms can provide an important complement to traditional demand response programs, which often entail enrollment barriers that deter participation by customers who would in fact be interested in automatically lowering their usage in emergency circumstances to avoid blackouts. The Commission should consider how advanced technologies like smart devices can improve mass public notification systems and increase the reliability and visibility of demand reductions during emergencies.

Currently, such programs rely heavily on customer behavioral responses to emergency alerts. For example, the California ISO's "Flex Alert" program encourages customers to reduce demand at peak times using mass media, social media, emails, and the ISO's mobile app.[48] The track record of this behavioral approach is mixed at best. Data from one smart thermostat manufacturer, AEE member ecobee, Inc., shows that customers with ecobee devices enrolled in utility demand response programs on August 17 and 18 during California's summer 2020 grid

[48] CAISO, What Is a Flex Alert?, *available at* https://www.flexalert.org/what-is-flex-alert.

emergency delivered substantially more load reductions than those that were not, since the latter customers took action only as a behavioral response to the Flex Alert system in California:

Figure 1 – ecobee customer HVAC runtime on August 17 & 18, 2020



This result is not surprising, given that the behavioral approach relies on customers being informed and engaged enough to actively respond to a general alert, and also sophisticated enough to understand what they can do to reduce their usage at key times. That expectation is simply unrealistic when it comes to more complex strategies like pre-cooling a home at non-peak times to avoid HVAC usage during a grid emergency.

Additionally, the one-way communication does not provide any visibility for grid operators as to the actual magnitude of that response in concrete megawatt terms. As the CPUC has recognized with respect to the CAISO Flex Alert program, this uncertainty means that it is "difficult to measure and verify [program impacts] due to the nature of mass market campaigns."[49] Accordingly, the effectiveness of emergency conservation efforts relying on a behavioral response has been an issue of significant debate in California, with no definitive way to substantiate the impacts of paid media on customer response to Flex Alerts.[50]

[49] *See, e.g.*, Application of Southern California Gas Co. for Adoption of Its 2020 Flex Alert Marketing Campaign, Decision 20-12-026 at 3-5 (CPUC Dec. 17, 2020).

[50] *See, e.g., id.* at 4-5; Application of Pacific Gas and Electric Company for Approval of 2013-2014 Statewide Marketing, Education and Outreach Program and Budget, Decision 19-07-010 at 7-8 (CPUC July 18, 2019); Application of Pacific Gas and Electric Company for Approval of 2013-2014 Statewide Marketing, Education and Outreach Program and Budget, A.12-08-008 *et al.*, Southern California Edison Company's (U 338-E) Flex Alert Transfer Proposal at 5-6, 10 (CPUC Apr. 1, 2014).

There is, therefore, significant room to improve on the predominant approach to mass public notifications soliciting voluntary load reductions to avoid system reliability emergencies. Smart thermostats can provide that improvement, both in terms of (1) achieving greater customer reductions in demand; and (2) ensuring that customer response is visible to grid operators to facilitate better grid management and potentially reduce the need to rely on other more costly resources. Up to 25% of households in the United States own some type of "connected" thermostat, representing gigawatts of flexible load that could respond during grid emergencies.[51] However, only a small fraction of smart thermostats are formally enrolled in a demand response program today, often due to enrollment barriers that have nothing to do with whether a customer would be interested in shifting their HVAC usage to alleviate a grid emergency.[52]

There are viable mechanisms to leverage smart thermostats as resources for grid resilience and reliability. At the distribution level, utilities may enter into emergency agreements with smart thermostat manufacturers, under which the manufacturers would signal customer thermostats to provide additional load reductions during emergencies. San Diego Gas & Electric Co. (SDG&E) proposed just such an approach in a proceeding exploring tools to avoid repetition of California's summer 2020 blackouts, and the California Public Utility Commission (CPUC) approved that proposal.[53] As SDG&E explained in its testimony, smart thermostat manufacturers "may have the

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[51] Statista, Which smart home devices does your household own?, https://www.statista.com/statistics/1124290/smart-home-device-ownership-us; Ryan Hledik *et al.*, The Brattle Group, The National Potential for Load Flexibility 18 (June 2019), *available at* https://brattlefiles.blob.core.windows.net/files/16639_national_potential_for_load_flexibility_-_final.pdf (estimating 198 GW of load flexibility potential by 2030, with a significant proportion coming from smart thermostats).

[52] Pollock & Fogel,2019 (Noting that in California the 2016 DRAM program required customers provide their utility service account number, which typically is not readily available. Then customers would complete a CISR-DRP form on paper or through a third-party site, which was a cumbersome and fatiguing process. As a result of these friction points, enrollment rates were just 3% of eligible DRAM customers.)

[53] Order Instituting Rulemaking to Establish Policies, Processes, and Rules to Ensure Reliable Electric Service in California in the Event of an Extreme Weather Event in 2021, Decision 21-03-056 at 39 (CPUC Mar.26, 2021); Order Instituting Rulemaking to Establish Policies, Processes, and Rules to Ensure Reliable Electric Service in California in the Event of an Extreme Weather Event in 2021, R.20-11-003, Prepared Direct Testimony of SDG&E Regarding Demand Response Proposals at 15-17 (CPUC Jan. 11, 2021).

ability to dispatch additional customers who are not enrolled in an SDG&E or other third-party DR program in extreme situations . . . . without formal enrollment of the individual participating customers in a DR program."[54] SDG&E plans to use device data provided by participating device manufacturers to quantify the resulting load reductions and to prevent double-counting of responses from customers enrolled in existing DR programs.[55] This approach of channeling voluntary reductions in energy usage through automated consumer devices not only lowers participation barriers by avoiding the hurdles of a separate enrollment process through a utility, but also provides better visibility for grid operators to determine the actual extent of the customer response to an emergency alert based on concrete data.

While this type of program is a step in the right direction, the Commission is in a position to more broadly tap into the flexible load resources available from smart thermostats during a grid emergency by facilitating direct wholesale market participation under Order No. 2222 (and potential future directives). Smart thermostat manufacturers are able to provide HVAC runtime data on a five-minute interval basis, which is sufficient to verify customer load reductions. Providing a direct route for manufacturers to participate in the wholesale market using such flexible sub-metering methodologies is a viable approach that will maximize the use of flexible demand resources. The Commission has already approved CAISO tariff modifications that allow behind-the-meter electric vehicle supply equipment (EVSE) to provide demand response resources directly in the wholesale market via sub-metering using the EVSE.[56] Similarly enabling wholesale market participation of devices like smart thermostats will avoid enrollment barriers at the distribution utility level, and also improve on the current piecemeal approach across different

[54] *Id.* at 15-17.
[55] *Id.* at 16-17.
[56] *California Independent System Operator Corporation*, Docket. No. ER20-2443-000, Order Accepting Tariff Revisions (Sept. 30, 2020), ¶¶ 4-5, 19.

service territories. Such an approach would equip RTOs/ISOs with a valuable tool to respond to reliability emergencies during extreme weather events.

17. Where climate change and extreme weather events may implicate both federal and state issues, should the Commission consider conferring with the states, as permitted under FPA section 209(b), to collaborate on such issues?

Collaboration with the states is critical, as many of the impacts of climate change and extreme weather events impact all segments of the electricity system, from the customer meter through the distribution and transmission system to bulk generators. Using FPA section 209(b) could be one tool for collaboration, but the Commission should not limit itself to formal approaches. Engagement with NARUC and hosting convenings with state policymakers (including commissioners, state energy offices, and legislators) can also yield positive outcomes. In addition, many states face resource constraints in addressing these types of issues, and can benefit from the expertise housed at the Commission, particularly in the area of reliability assessment and planning.

III. CONCLUSION

AEE appreciates the opportunity to provide these initial comments regarding the role of advanced energy technologies in addressing the impacts of climate change and extreme weather events on the electric grid. We look forward to further engaging with the Commission on these issues, and stand ready to assist the Commission and staff in developing the June 1-2 Technical Conference.

Respectfully submitted,

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